

## CLAIMS

**[C001]** 1. A method for analyzing business risk using qualitative business event information, comprising:

retrieving a plurality of articles each containing qualitative business event information relevant to a target business entity;

extracting a structured events record of details for the qualitative business event information from the plurality of articles; and

applying the structured events record to a business risk model that uses temporal reasoning to map qualitative business event information to business risk, wherein the business risk model determines the business risk of the target business entity based on temporal proximity and order of the qualitative business event information in the structured events record.

**[C002]** 2. The method according to claim 1, wherein the retrieving comprises:

searching a plurality of natural language sources for articles mentioning the target business entity;

determining whether the articles contain keywords and text patterns that are representative of events of interest for the target business entity; and

ascertaining whether the keywords and text patterns in the articles are within a reasonable proximity to the target business entity.

**[C003]** 3. The method according to claim 2, further comprising removing articles that do not have keywords or text patterns within a reasonable proximity to the target business entity.

**[C004]** 4. The method according to claim 2, wherein the ascertaining comprises using a plurality of proximity rules to identify whether the keywords and text patterns are likely related to the target business entity.

**[C005]** 5. The method according to claim 2, further comprising generating a confidence measure for each article ascertained to have keywords and text patterns within a reasonable proximity to the target business entity, wherein the confidence measure is an indication of the belief that the article contains an event of interest that is relevant to the target business entity.

**[C006]** 6. The method according to claim 1, wherein the extracting comprises:

retrieving paragraphs of text containing the event information relevant to the target business entity from each of the plurality of articles;

parsing each sentence within the paragraphs into component parts of speech and grammar structure;

extracting event details and relationships between events and the target business entity from the component parts of speech and grammar structure; and

generating the structured events record from the extracted event details and relationships.

**[C007]** 7. The method according to claim 6, wherein the extracting of event details and relationships between events and the target business entity comprises:

locating the target business entity and keywords that are representative of events of interest in each sentence;

identifying roles of the keywords in the sentences; and

determining relationships between events and the target business entity based on the roles of the keywords.

**[C008]** 8. The method according to claim 7, further comprising identifying sense and direction of the events in the sentences.

**[C009]** 9. The method according to claim 1, wherein the structured events record comprises an event category, event keywords within each sentence of an article, roles

of the keywords within each sentence, relationships between the events and the target business entity and sense and direction of the events.

**[C010]** 10. The method according to claim 1, wherein the applying of the structured events record to a business risk model comprises comparing the structured events record to templates of pattern events, wherein each template comprises a number and type of events that form a pattern in an event category and temporal constraints that exist between the events.

**[C011]** 11. The method according to claim 10, further comprising identifying templates of pattern events that match the structured events record.

**[C012]** 12. The method according to claim 11, further comprising generating a probability of risk measure based on the degree of match between the identified templates of pattern events and the structured events record.

**[C013]** 13. The method according to claim 1, wherein the business risk model utilizes at least one of case-based reasoning and a Bayesian belief network.

**[C014]** 14. The method according to claim 1, further comprising generating an alert when the business risk model determines that the risk of the target business entity has reached a predetermined threshold.

**[C015]** 15. A method for analyzing business risk of a target business entity from qualitative event business information, comprising:

retrieving a plurality of articles each containing qualitative event information relevant to the target business entity, wherein the retrieved articles contain keywords and text patterns that are representative of events of interest for the target business entity and are within a reasonable proximity to the target business entity;

parsing each sentence within a paragraph of text from an article that contains keywords and text patterns into component parts of speech and grammar structure;

extracting event details and relationships between events and the target business entity from the component parts of speech and grammar structure;

generating a structured events record from the extracted event details and relationships;

comparing the structured events record to templates of pattern events, wherein each template comprises a number and type of events that form a pattern in an event category and temporal constraints that exist between the events;

using temporal based reasoning to identify templates of pattern events that match the structured events record; and

generating a probability of risk measure based on the degree of match between the identified templates of pattern events and the structured events record.

**[C016]** 16. The method according to claim 15, wherein the retrieving comprises using a plurality of proximity rules to identify whether the keywords and text patterns in the articles are likely related to the target business entity.

**[C017]** 17. The method according to claim 15, wherein the extracting of event details and relationships between events and the target business entity comprises:

locating the target business entity and keywords that are representative of events of interest in each sentence;

identifying roles of the keywords in the sentences; and

determining relationships between events and the target business entity based on the roles of the keywords.

**[C018]** 18. The method according to claim 17, further comprising identifying sense and direction of the events in the sentences.

**[C019]** 19. The method according to claim 15, wherein the structured events record comprises an event category, event keywords within each sentence of an article, roles of the keywords within each sentence, relationships between the events and the target business entity and sense and direction of the events.

[C020] 20. The method according to claim 15, wherein the using of temporal based reasoning to identify templates of pattern events that match the structured events record comprises utilizing at least one of case-based reasoning and a Bayesian belief network.

[C021] 21. The method according to claim 15, further comprising generating an alert when the probability of risk measure reaches a predetermined threshold.

[C022] 22. A method for monitoring business risk of a target business entity using qualitative event business information, comprising:

searching a plurality of natural language sources for articles mentioning the target business entity;

retrieving a plurality of articles each containing qualitative event business information relevant to the target business entity, wherein the retrieved articles contain keywords and text patterns that are representative of events of interest for the target business entity and are within a reasonable proximity to the target business entity;

determining whether any of the retrieved articles contain unanalyzed qualitative event business information;

for articles containing unanalyzed qualitative event business information, parsing each sentence within a paragraph of text from the article into component parts of speech and grammar structure;

extracting event details and relationships between events and the target business entity from the component parts of speech and grammar structure;

generating a structured events record from the extracted event details and relationships;

comparing the structured events record to templates of pattern events, wherein each template comprises a number and type of events that form a pattern in an event category and temporal constraints that exist between the events;

using temporal based reasoning to identify templates of pattern events that match the structured events record; and

generating a probability of risk measure based on the degree of match between the identified templates of pattern events and the structured events record.

**[C023]** 23. The method according to claim 22, wherein the extracting of event details and relationships between events and the target business entity comprises:

locating the target business entity and keywords that are representative of events of interest in each sentence;

identifying roles of the keywords in the sentences; and

determining relationships between events and the target business entity based on the roles of the keywords.

**[C024]** 24. The method according to claim 22, wherein the structured events record comprises an event category, event keywords within each sentence of an article, roles of the keywords within each sentence, relationships between the events and the target business entity and sense and direction of the events.

**[C025]** 25. The method according to claim 22, wherein the using of temporal based reasoning to identify templates of pattern events that match the structured events record comprises utilizing at least one of case-based reasoning and a Bayesian belief network.

**[C026]** 26. The method according to claim 22, further comprising generating an alert when the probability of risk measure reaches a predetermined threshold.

**[C027]** 27. A system for analyzing business risk from qualitative business event information, comprising:

a search component configured to search and retrieve a plurality of articles each containing qualitative business event information relevant to a target business entity;

an extraction engine component configured to extract a structured events record of details of the qualitative business event information retrieved from the plurality of articles; and

a business risk model component configured to map the structured events record of the target business entity to a business risk measure, wherein the business risk model component determines the business risk measure based on temporal proximity and order of the qualitative business event information in the structured events record.

[C028] 28. The system according to claim 27, further comprising a text pattern database defining a set of keywords and text patterns that are representative of events of interest.

[C029] 29. The system according to claim 28, wherein the search component is configured to search a plurality of natural language sources for articles mentioning the target business entity and access the text pattern database to determine whether the articles contain keywords and text patterns that are representative of events of interest for the target business entity.

[C030] 30. The system according to claim 29, further comprising a proximity checking component configured to ascertain whether the keywords and text patterns in the articles are within a reasonable proximity to the target business entity.

[C031] 31. The system according to claim 30, wherein the proximity checking component is configured to remove articles that do not have keywords or text patterns within a reasonable proximity to the target business entity.

[C032] 32. The system according to claim 30, wherein the proximity checking component is configured to use a plurality of proximity rules to identify whether the keywords and text patterns are likely related to the target business entity.

[C033] 33. The system according to claim 30, wherein the proximity checking component is configured to generate a confidence measure for each article ascertained to have keywords and text patterns within a reasonable proximity to the target

business entity, wherein the confidence measure is an indication of the belief that the article contains an event of interest that is relevant to the target business entity.

**[C034]** 34. The system according to claim 27, wherein the extraction engine component comprises a grammar parsing tool configured to receive paragraphs of text containing the event information relevant to a target business entity from each of the plurality of articles and parse each sentence within the paragraphs into component parts of speech and grammar structure.

**[C035]** 35. The system according to claim 34, further comprising a semantic analysis tool configured to extract event details and relationships between events and the target business entity from the component parts of speech and grammar structure.

**[C036]** 36. The system according to claim 35, wherein the semantic analysis tool is configured to locate the target business entity and keywords that are representative of events of interest in each sentence, identify roles of the keywords in the sentences, and determine relationships between events and the target business entity based on the roles of the keywords.

**[C037]** 37. The system according to claim 36, wherein the semantic analysis tool is configured to identify sense and direction of the events in the sentences.

**[C038]** 38. The system according to claim 27, wherein the structured events record comprises an event category, event keywords within each sentence of an article, roles of the keywords within each sentence, relationships between the events and the target business entity and sense and direction of the events.

**[C039]** 39. The system according to claim 27, further comprising a pattern events database that comprises templates of pattern events, wherein each template comprises a number and type of events that form a pattern in an event category and temporal constraints that exist between the events.

**[C040]** 40. The system according to claim 39, wherein the business risk model component is configured to compare the structured events record to the templates of



pattern events and identify templates of pattern events that match the structured events record.

**[C041]** 41. The system according to claim 40, wherein the business risk model component is configured to generate a probability of risk measure based on the degree of match between the identified templates of pattern events and the structured events record.

**[C042]** 42. The system according to claim 27, wherein the business risk model component utilizes at least one of case-based reasoning and a Bayesian belief network.

**[C043]** 43. The system according to claim 27, further comprising an alert component configured to generate an alert when the business risk model component determines that the risk of the target business entity has reached a predetermined threshold.

**[C044]** 44. A system for analyzing business risk of a target business entity from qualitative event business information, comprising:

a text pattern database defining a set of keywords and text patterns that are representative of events of interest;

a search component configured to search a plurality of natural language sources and retrieve a plurality of articles each containing keywords and text patterns defined in the text pattern database;

an extraction engine component configured to extract a structured events record from the plurality of articles, wherein the extraction engine component comprises a grammar parsing tool configured to receive paragraphs of text containing the keywords and text patterns from each of the plurality of articles and parse each sentence within the paragraphs into component parts of speech and grammar structure; and a semantic analysis tool configured to extract event details and relationships between events and the target business entity from the component parts of speech and grammar structure;

a pattern events database that comprises templates of pattern events, wherein each template comprises a number and type of events that form a pattern in an event category and temporal constraints that exist between the events; and

a pattern analyzer configured to use temporal reasoning to compare the structured events record to the templates of pattern events and identify templates of pattern events that match the structured events record.

**[C045]** 45. The system according to claim 44, further comprising a proximity checking component configured to ascertain whether the keywords and text patterns in the retrieved articles are within a reasonable proximity to the target business entity.

**[C046]** 46. The system according to claim 45, wherein the proximity checking component is configured to remove articles that do not have keywords or text patterns within a reasonable proximity to the target business entity.

**[C047]** 47. The system according to claim 45, wherein the proximity checking component is configured to use a plurality of proximity rules to identify whether the keywords and text patterns are likely related to the target business entity.

**[C048]** 48. The system according to claim 44, wherein the semantic analysis tool is configured to locate the target business entity and keywords in each sentence, identify roles of the keywords in the sentences, and determine relationships between events and the target business entity based on the roles of the keywords.

**[C049]** 49. The system according to claim 48, wherein the semantic analysis tool is configured to identify sense and direction of the events.

**[C050]** 50. The system according to claim 44, wherein the structured events record comprises an event category, event keywords within each sentence of an article, roles of the keywords within each sentence, relationships between the events and the target business entity and sense and direction of the events.

[C051] 51. The system according to claim 44, wherein the pattern analyzer is configured to generate a probability of risk measure based on the degree of match between the identified templates of pattern events and the structured events record.

[C052] 52. The system according to claim 44, wherein the pattern analyzer utilizes at least one of case-based reasoning and a Bayesian belief network.

[C053] 53. The system according to claim 44, further comprising an alert component configured to generate an alert when the pattern analyzer determines that the risk of the target business entity has reached a predetermined threshold.

[C054] 54. A computer-readable medium storing computer instructions for instructing a computer system to analyze business risk using qualitative business event information, the computer instructions comprising:

retrieving a plurality of articles each containing qualitative business event information relevant to a target business entity;

extracting a structured events record of details for the qualitative business event information from the plurality of articles; and

applying the structured events record to a business risk model that uses temporal reasoning to map qualitative business event information to business risk, wherein the business risk model component determines the business risk of the target business entity based on temporal proximity and order of the qualitative business event information in the structured events record.

[C055] 55. The computer-readable medium according to claim 54, wherein the retrieving comprises instructions for:

searching a plurality of natural language sources for articles mentioning the target business entity;

determining whether the articles contain keywords and text patterns that are representative of events of interest for the target business entity; and

ascertaining whether the keywords and text patterns in the articles are within a reasonable proximity to the target business entity.

**[C056]** 56. The computer-readable medium according to claim 55, further comprising instructions for removing articles that do not have keywords or text patterns within a reasonable proximity to the target business entity.

**[C057]** 57. The computer-readable medium according to claim 55, wherein the ascertaining comprises instructions for using a plurality of proximity rules to identify whether the keywords and text patterns are likely related to the target business entity.

**[C058]** 58. The computer-readable medium according to claim 55, further comprising instructions for generating a confidence measure for each article ascertained to have keywords and text patterns within a reasonable proximity to the target business entity, wherein the confidence measure is an indication of the belief that the article contains an event of interest that is relevant to the target business entity.

**[C059]** 59. The computer-readable medium according to claim 54, wherein the extracting comprises instructions for:

retrieving paragraphs of text containing the event information relevant to the target business entity from each of the plurality of articles;

parsing each sentence within the paragraphs into component parts of speech and grammar structure;

extracting event details and relationships between events and the target business entity from the component parts of speech and grammar structure; and

generating the structured events record from the extracted event details and relationships.

**[C060]** 60. The computer-readable medium according to claim 59, wherein the extracting of event details and relationships between events and the target business entity comprises instructions for:

locating the target business entity and keywords that are representative of events of interest in each sentence;

identifying roles of the keywords in the sentences; and

determining relationships between events and the target business entity based on the roles of the keywords.

**[C061]** 61. The computer-readable medium according to claim 60, further comprising instructions for identifying sense and direction of the events in the sentences.

**[C062]** 62. The computer-readable medium according to claim 54, wherein the structured events record comprises an event category, event keywords within each sentence of an article, roles of the keywords within each sentence, relationships between the events and the target business entity and sense and direction of the events.

**[C063]** 63. The computer-readable medium according to claim 54, wherein the applying of the structured events record to a business risk model comprises instructions for comparing the structured events record to templates of pattern events, wherein each template comprises a number and type of events that form a pattern in an event category and temporal constraints that exist between the events.

**[C064]** 64. The computer-readable medium according to claim 63, further comprising instructions for identifying templates of pattern events that match the structured events record.

**[C065]** 65. The computer-readable medium according to claim 64, further comprising instructions for generating a probability of risk measure based on the degree of match between the identified templates of pattern events and the structured events record.

[C066] 66. The computer-readable medium according to claim 54, wherein the business risk model utilizes at least one of case-based reasoning and a Bayesian belief network.

[C067] 67. The computer-readable medium according to claim 54, further comprising instructions for generating an alert when the business risk model determines that the risk of the target business entity has reached a predetermined threshold.

[C068] 68. A computer-readable medium storing computer instructions for instructing a computer system to analyze business risk of a target business entity from qualitative event business information, the computer instructions comprising:

retrieving a plurality of articles each containing qualitative event information relevant to the target business entity, wherein the retrieved articles contain keywords and text patterns that are representative of events of interest for the target business entity and are within a reasonable proximity to the target business entity;

parsing each sentence within a paragraph of text from an article that contains keywords and text patterns into component parts of speech and grammar structure;

extracting event details and relationships between events and the target business entity from the component parts of speech and grammar structure;

generating a structured events record from the extracted event details and relationships;

comparing the structured events record to templates of pattern events, wherein each template comprises a number and type of events that form a pattern in an event category and temporal constraints that exist between the events;

using temporal based reasoning to identify templates of pattern events that match the structured events record; and

generating a probability of risk measure based on the degree of match between the identified templates of pattern events and the structured events record.

**[C069]** 69. The computer-readable medium according to claim 68, wherein the retrieving comprises instructions for using a plurality of proximity rules to identify whether the keywords and text patterns in the articles are likely related to the target business entity.

**[C070]** 70. The computer-readable medium according to claim 68, wherein the extracting of event details and relationships between events and the target business entity comprises instructions for:

locating the target business entity and keywords that are representative of events of interest in each sentence;

identifying roles of the keywords in the sentences; and

determining relationships between events and the target business entity based on the roles of the keywords.

**[C071]** 71. The computer-readable medium according to claim 70, further comprising instructions for identifying sense and direction of the events in the sentence.

**[C072]** 72. The computer-readable medium according to claim 68, wherein the structured events record comprises an event category, event keywords within each sentence of an article, roles of the keywords within each sentence, relationships between the events and the target business entity and sense and direction of the events.

**[C073]** 73. The computer-readable medium according to claim 68, wherein the using of temporal based reasoning to identify templates of pattern events that match the structured events record comprises instructions for utilizing at least one of case-based reasoning and a Bayesian belief network.

**[C074]** 74. The computer-readable medium according to claim 68, further comprising instructions for generating an alert when the probability of risk measure reaches a predetermined threshold.